

**General information**

Wellbore name	25/11-21 A
Type	EXPLORATION
Purpose	APPRAISAL
Status	RE-CLASS TO TEST
Factmaps in new window	link to map
Main area	NORTH SEA
Field	GRANE
Discovery	25/11-15 Grane
Well name	25/11-21
Seismic location	NH 9301-ROW 1405 & COLUMN 1750
Production licence	169
Drilling operator	Norsk Hydro Produksjon AS
Drill permit	845-L
Drilling facility	TREASURE SAGA
Drilling days	143
Entered date	12.05.1996
Completed date	01.10.1996
Release date	01.10.1998
Publication date	29.08.2003
Purpose - planned	APPRAISAL
Reentry	NO
Content	OIL
Discovery wellbore	NO
1st level with HC, age	PALEOCENE
1st level with HC, formation	HEIMDAL FM
Kelly bushing elevation [m]	26.0
Water depth [m]	129.0
Total depth (MD) [m RKB]	3006.0
Final vertical depth (TVD) [m RKB]	1801.3
Maximum inclination [°]	90.4
Bottom hole temperature [°C]	81
Oldest penetrated age	PALEOCENE
Oldest penetrated formation	LISTA FM
Geodetic datum	ED50
NS degrees	59° 9' 43.43" N
EW degrees	2° 27' 53.07" E
NS UTM [m]	6558372.45
EW UTM [m]	469391.49



UTM zone	31
NPDID wellbore	2812

Wellbore history

General

Well 25/11-21 S was drilled on the Grane Field. The primary objectives of well 25/11-21 S were to calibrate the depth conversion model with reference to top and base of the Grane reservoir and the oil-water contact, and to investigate horizontal and vertical reservoir barriers and reservoir heterogeneities. The secondary objectives of well 25/11-21 S were to obtain reservoir and fluid data and to investigate uncontaminated initial water saturation values in the oil zone. The well location was selected to allow building up hole angle for later drilling of a horizontal section (25/11-21 A) at the required depth and coordinates and at the same time to provide an accurate seismic tie, i.e. an area with minimal compaction effects and away from faults, in an area where there are indications of a thick sand on the seismic data.

Sidetrack well 25/11 -21 A was drilled to obtain 600 m to 900 m of horizontal reservoir information. The objectives were to appraise the reservoir in terms of reservoir quality and to confirm the structural top and base reservoir maps; to obtain lateral velocity information for calibration of the depth conversion model; to identify possible reservoir heterogeneities indicated on seismic; and finally to perform an extended test production in the horizontal section of the well.

Operations and results

Appraisal well 25/11-21 S was spudded with the semi-submersible installation "Treasure Saga" on 23 October 1995 and drilled to TD at 1957 m (1863.5 m TVD MSL) in Late Cretaceous Hod Formation. The well was drilled with seawater and hi-vis bentonite sweeps down to 1270 m and with KCl / Polymer mud from 1270 m to TD.

Heimdal Formation sand was penetrated at 1788 m (1711.5 m TVD MSL). A reservoir thickness of 88 m (79.5 m TVD) was defined, giving a net pay of 57.9 m. The pressure data from the Heimdal Formation indicates a 0.4 bar pressure difference to well 25/11-18 T2 and 1.7 bar difference to well 25/11-15 based on HP gauge measurements. The oil-water contact (FWL) in the well was found at 1765 m TVD MSL, i.e. more or less the same as in well 25/11-18-T2 and 2.5 meters deeper than in well 25/11-15. No free gas cap was found. Both the top and base reservoir seismic reflectors and the depth conversion model were proven to be correct in the area, and the reservoir characteristics as found in wells 25/11-15 and 25/11-18 T2 were confirmed. A walk away VSP and walk away AVO VSP were acquired in well 25/11-21 S yielding good quality high resolution data. The entire reservoir section was cored from 1778 m to 1880.5 m. The wire line logging programme was followed successfully except for an operational failure of the GHMT-tool. MDT Oil samples were taken at 1790 m (1713.09 m TVD MSL), 1796 m (1718.6 m TVD MSL), 1813 m (1734 m TVD MSL), 1828 m (1747.4 m TVD MSL), 1830 m (1749.4 m TVD MSL), 1837.5 m (1756.2 m TVD MSL), and 1845 m (1763 m TVD MSL). MDT water samples were taken at 1850 m (1767.5 m TVD MSL), 1855 m (1772.1 m TVD MSL), 1861.5 m (1777.9 m TVD MSL), and 1874 m (1789.2 m TVD MSL). Well 25/11-21 S was plugged back to the 13 3/8" casing shoe and suspended as an oil appraisal on 14 November 1995.

The well was re-entered with the semi-submersible installation "Treasure Saga" on 15 May 1996. Well 25/11-21 A was kicked off at 1262 m and drilled down to 1973 m in the Heimdal Formation. The hole was drilled with a too low angle to reach the 10 3/4" casing point within acceptable tolerances. Thus the hole was plugged back from 1973 m, and a



technical sidetrack, 25/11-21 A T2, was drilled from 1783 m, continued inclined to horizontal, and drilled to TD at 3006 m (1801.4 m TVD MSL) in the Late Paleocene Lista Formation. The sidetrack was drilled water based with KCl / Polymer mud from kick off to 2448 m and with CaCO₃ / NaCl mud from 2448 m to TD. In well 25/11-21 A T2, the top of the Heimdal Formation sand was penetrated at 1837.5 m (1705.7 m TVD MSL). At a depth of 1749 m TVD MSL a 820 m horizontal section was drilled. Here a 3 m thick calcite cemented layer, corresponding to an intra reservoir reflector, was penetrated at 2514.5 m. A deformed shaly zone, penetrated at 2627.5 - 2652 was probably due to drilling very close to top reservoir in this area. The Base of the Heimdal Formation was reached at 1765.7 m TVD MSL. The reservoir quality of the Heimdal sand is good, showing average porosities of 33%, and a general porosity increase from the SW towards the NE along the well path. The net to gross ratio of the Heimdal Formation is 0.98, due to the penetrated cemented and shaly zones. The oil-water contact (FWL) was found at 1765.6 m TVD MSL, confirming the results from the wells 25/11-21 S and 25/11-18 T2. The average oil saturation within the oil zone is 90%. Only MWD logs were obtained in the sidetrack. No wire line logs were run; consequently no fluid samples were taken on wire line. No conventional or sidewall cores were cut in the sidetrack. After an extended well test well 25/11-21 A was permanently abandoned as an oil appraisal on 1 October 1996

Testing

An extended well test (25/11-T-21 A) from the interval 2048 m to 2606 m (1904.2 +/- 0.2 m TVD) in the horizontal section of well 25/11-21 A was carried out during the summer of 1996. The produced oil was stored on the storage tanker "Hellespoint Energy" and the associated gas was flared off from the "Treasure Saga" burner boom. After installation of sand screens and external casing packers, the screen washing and the setting of screen packer were halted for about a month due to a NOPEF strike. During this period the formation around the well bore received approximately 800m³ of drilling mud, kill pills and completion fluids. After the strike the well was put on production. At high production rates (up to 3000 Sm³/day) and especially after the well had started to produce water loss of pressure was observed. The reason for this was probably plugging by particles from the completion fluid. With careful increases in the production rate and with production rates between 800 to 1000 Sm³ the well was flowing with a Productivity Index of approximately 150 Sm³/d/bar at the end of the extended well test period. The static bottom hole pressure was 170 bar and the maximum temperature measured during the test was 81.4 deg C. An extensive fluid sampling programme was carried out. Based on single stage flash analyses of bottom hole samples to 1 atmosphere and 15 deg C the oil density was 0.94 g/cm³, and the corresponding GOR was 14.7 Sm³/Sm³. Gas gravity of separator samples was 0.632 (air = 1).

Cuttings at the Norwegian Offshore Directorate

Cutting sample, top depth [m]	Cutting samples, bottom depth [m]
1270.00	3000.00

Cuttings available for sampling?	YES
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Palynological slides at the Norwegian Offshore Directorate

Sample depth	Depth unit	Sample type	Laboratory
1730.0	[m]	DC	RRI
1735.0	[m]	DC	RRI



1737.0	[m]	DC	RRI
1740.0	[m]	DC	RRI
1742.0	[m]	DC	RRI
1745.0	[m]	DC	RRI
1752.0	[m]	DC	RRI
1760.0	[m]	DC	RRI
1767.0	[m]	DC	RRI
1775.0	[m]	DC	RRI
1782.0	[m]	DC	RRI
1790.0	[m]	DC	RRI
1797.0	[m]	DC	RRI
1805.0	[m]	DC	RRI
1812.0	[m]	DC	RRI
1827.0	[m]	DC	RRI
1832.0	[m]	DC	RRI
1837.0	[m]	DC	RRI
2650.0	[m]	DC	RRI
2652.0	[m]	DC	RRI
2655.0	[m]	DC	RRI
2710.0	[m]	DC	RRI
2715.0	[m]	DC	RRI
2982.0	[m]	DC	RRI

Oil samples at the Norwegian Offshore Directorate

Test type	Bottle number	Top depth MD [m]	Bottom depth MD [m]	Fluid type	Test time	Samples available
DST		0.00	0.00		01.05.1996 - 00:00	YES

Lithostratigraphy

Top depth [mMD RKB]	Lithostrat. unit
155	NORDLAND GP
720	NO FORMAL NAME
796	HORDALAND GP
796	SKADE FM
905	NO FORMAL NAME



925	SKADE FM
944	NO FORMAL NAME
955	SKADE FM
978	NO FORMAL NAME
1000	SKADE FM
1028	NO FORMAL NAME
1074	SKADE FM
1087	NO FORMAL NAME
1102	SKADE FM
1115	NO FORMAL NAME
1221	SKADE FM
1230	NO FORMAL NAME
1736	ROGALAND GP
1736	BALDER FM
1745	SELE FM
1757	LISTA FM
1838	HEIMDAL FM
2628	LISTA FM
2630	HEIMDAL FM
2633	LISTA FM
2640	HEIMDAL FM
2645	LISTA FM
2652	HEIMDAL FM
2710	LISTA FM
2713	HEIMDAL FM
2968	LISTA FM

Composite logs

Document name	Document format	Document size [MB]
2812	pdf	0.42

Documents - reported by the production licence (period for duty of secrecy expired)

Document name	Document format	Document size [MB]
2812_25_11_21_A_COMPLETION_REPORT_AND_COMPLETION_LOG	pdf	7.32



**Logs**

Log type	Log top depth [m]	Log bottom depth [m]
LWD CLLS - SONIC	2000	2970
MWD DPR - GR RES	1240	1550
MWD MDL/MNP - NEU DEN	2020	2990
MWD RNT - NAVIGATOR	1550	3000

Casing and leak-off tests

Casing type	Casing diam. [inch]	Casing depth [m]	Hole diam. [inch]	Hole depth [m]	LOT/FIT mud eqv. [g/cm3]	Formation test type
LINER	10 3/4	2034.0	12 1/4	2034.0	0.00	LOT
OPEN HOLE		3006.0	9 1/2	3006.0	0.00	LOT

Drilling mud

Depth MD [m]	Mud weight [g/cm3]	Visc. [mPa.s]	Yield point [Pa]	Mud type	Date measured
1030	1.30			WATER BASED	
1262	1.37	24.0		WATER BASED	
1424	1.37	21.0		WATER BASED	
1715	1.37	21.0		WATER BASED	
1841	1.37	26.0		WATER BASED	
1894	1.37	22.0		WATER BASED	
1936	1.37	24.0		WATER BASED	
1973	1.37	24.0		WATER BASED	
2024	1.37	26.0		WATER BASED	
2448	1.29	27.0		WATER BASED	
2760	1.20			WATER BASED	
2998	1.30	29.0		WATER BASED	
3006	1.30	29.0		WATER BASED	